REMARKS

Claims 1-24 are pending. Claims 1-24 are rejected. Claims 6, 22 and 23 are objected to. Claims 4, 6, 9, 22 and 23 are amended. Support for the amendments can be found throughout the application, for instance in the specification and claims as originally filed. No new matter is added.

Applicants would like to thank Examiners John R Lee and Bernard E Souw for taking the time to conduct a telephone interview with Applicants' representative on April 8, 2003. Claims 1-24 are submitted for further consideration in view of the comments and suggestions of the telephone interview, as well as the remarks below. Applicants respectfully request reconsideration and withdrawal of all objections and rejections.

Objections to Specification

The specification is objected to for informalities. First, paragraph [0005] of the specification is objected to for defining energy contamination as a particle. Applicants respectfully disagree. Applicants first point out that they applicants may decide to be their own lexicographer, as is properly done in this application. It is further pointed out that in the application, the definition of the phrase "energy contamination" is consistent with the technical meaning widely known to those of ordinary skill in the art/field of ion optics. As evidence of such widely known meaning, Applicants submit a copy of the Handbook of Ion Implantation Technology, pages 675 to 692, edited by J. F. Ziegler, with reference in particular to the description at pages 686-687 of the document. According to this description, energy contamination results from two reactions, as mentioned in conjunction

with Figure 12. Applicants point out that such energy contamination results from the fact that an ion beam, namely a beam of charged particles, is neutralized into a neutralized beam (an atom beam). The neutralized beam occurs by stripping charges from the ion beam. *See* page 686 of document. The neutralized beam cannot be measured in the form of a current because of absence of any charge, and thus Applicants take the opportunity to point out that the energy contamination may only be obtained by estimation. Nevertheless, Applicants urge that consistent with the explanation of "energy contamination" in the submitted document, is the "energy contamination" of a beam, or a beam of charged particles, as is discussed at paragraph [0005] of the specification.

Second, it is alleged that since the term I_{ID} is undefined in the specification, the phrase energy contamination ratio is also undefined. Applicant respectfully disagree. As discussed above, the meaning of "energy contamination" is well known to those of ordinary skill in the art, as evidenced by the Handbook of Ion Implantation Technology submitted herein. Perhaps more important, Applicants point out that the term I_{ID} is indeed set forth in the specification. In paragraph [0048] of the specification, it is stated that a beam electric current I_{ID} implanted into the wafer is equal to a beam electric current measured at the Faraday disc 14 which may be called a second Faraday cup. Clearly, the term I_{ID} and thus the phrase energy contamination are well defined by the specification.

Applicants urge withdrawal of the objections.

Claim Objections

Claims 22 and 23 are objected to for informalities. In claim 22, the phrase "starts to impinge a wafer" is objected to. Applicants respectfully submit that the objection is moot in

view of the amendment of claim 22 indicated herein, in accordance with the suggestion at page 3 of the Office Action.

Claim 23 is also objected to for its alleged form. Applicants respectfully submit that this objection is also moot in view of the amendment of claim 23 as indicated herein. Applicants note that claim 23 as would appear to result from the marked-up claim 23 of the Response filed November 5, 2002 has been amended. It is further pointed out that despite the comments at page 3 of the Office Action, claim 23 is concerned with a specified ratio of energy contamination that is automatically converted to the limit of the beam transport efficiency. As explained throughout the specification, there is a clear correlation between energy contamination and beam transport efficiency. See e.g., Figure 4 and paragraph [0039] of the specification. Claim 23 is clear and proper.

Applicants urge withdrawal of all claim objections.

Claim Rejections - 35 U.S.C. 112

Claims 6 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Regarding claim 6, it is alleged that the phrase "determined in consideration of" renders the claim indefinite. Applicants respectfully submit that the rejection is moot in view of the amendment of claim 6 indicated herein. Support for the amendment can be found throughout the application, for instance at paragraphs [0011], [0033] and [0058] of the specification.

With respect to claim 9, it is alleged that merely "monitoring the beam transport efficiency" will not reduce the energy contamination. Applicants respectfully submit that this rejection is also moot in view of the amendment of claim 9 indicated herein.

Applicants urge withdrawal of the rejections.

Claim Rejections - 35 U.S.C. 101

Claims 4 and 6 rejected under 35 U.S.C. 101. It is alleged that claim 4 is directed to physical law, and thus non-statutory subject matter. The rejection is moot in view of the amendment of claim 4 indicated herein. Support for the amendment can be found throughout the application, for instance at Figure 4 and paragraph [0058] of the specification.

With respect to claim 6, it is alleged that a "ratio" cannot be part of an apparatus. It is also alleged that "consideration" of a deceleration ratio is ineffective because the act of "considering" is not a step necessary to accomplish something real. Applicants respectfully submit that the rejection is moot in view of the amendment of claim 6 as indicated herein. Support for the amendment can be found throughout the application, for instance at paragraphs [0011], [0033] and [0058] of the specification.

Applicants urge withdrawal of the rejections.

New Matter - 35 U.S.C. 132

The amendment filed on November 5, 2002 is objected to 35 U.S.C. 132 for allegedly introducing new matter. It is alleged that the claim 1 phrase "beam electric currents" constitutes new matter. Applicants respectfully disagree. As noted during the telephone interview on April 8, 2003, the phrase "beam electric currents" is fully supported by the specification. For example, at paragraphs [0047] and [0048], the specification

refers to the measuring of "beam electric currents" in accordance with the claimed invention. No new matter has been introduced.

It is also alleged that the phrase "beam transport efficiency" is undefined in claims 7-9, 11-15, 17, 19 and 21-24 since the term I_{ID} is undefined in the specification. Applicants again respectfully disagree. As discussed above, the meaning of the term I_{ID} is set forth at least at paragraph [0048] of the specification, and thus the meaning of "beam transport efficiency" is clear. Again, no new matter has been included in the claims.

Applicants urge withdrawal of the rejections.

Claim Rejections - 35 U.S.C. 103

Claims 1-24 are rejected under 35 U.S.C. 103(a) as being obvious over Adibi et al. (U.S. Patent No. 5,883,391).

Applicants respectfully disagree.

Adibi et al. has been discussed in the Response filed November 5, 2002.

In contrast to Adibi et al., in preferred embodiments the present invention is concerned with measuring or estimating energy contamination in consideration of beam transportation efficiency between two measurement positions. Applicants point out that in the present invention, a never before heard of approach was required to estimate energy contamination by introducing the new concepts of "beam transportation efficiency" and "ratio of energy contamination", these concepts also never before disclosed in the prior art. Applicants note in particular that in preferred embodiments, beam transportation efficiency defined in relation to a neutralized beam may be estimated from beam electric currents that are measured at two different positions, because the neutralized beam itself has no

charge and cannot be directly measured, as has been previously discussed. It is noted that the two different positions may be at upstream and downstream positions along an ion beam path by a Faraday cup 12 and disc 14, respectively. *See* Figure 2.

Applicants also point out that the beam electric current measured at the upstream position is represented by I_{iF} whereas the beam electric current measured at the downstream is represented by I_{iD}, as mentioned at page 12 (e.g., paragraphs [0048] and [0049]) of the specification. It is to be noted that the ion beam diverges as it moves downstream. In this connection, the beam electric current measured at the upstream position includes a high rate of ion beam while the beam electric current measured at the downstream position is weak due to diversion of the ion beam, and also includes a low rate of the beam electric current as compared with the beam electric current measured at the upstream position. That is, the beam electric currents of the ion beam are varied between the upstream and the downstream positions due to the diversion of the ion beam, and a variation of the beam electric currents is defined as beam transport efficiency, represented by ε_N.

Applicants likewise note that assumption or estimation is made with respect to variation of the neutralized beam between the upstream and downstream positions. The variation of the neutralized beam is defined as beam transport efficiency. Herein, it is assumed that the neutralized rate of the ion beam is constant between the upstream and downstream positions and that the beam transport efficiency ε_N is substantially equal to the rate of the energy contamination due to the neutralized beam. Applicants again urge that such analysis and assumption or estimation were not known in the art prior to the filing of the application.

From the above, it would be readily understood by those of ordinary skill in the art that is now possible to estimate energy contamination, that is defined in relation to a neutralized beam, by measuring beam electric currents at a plurality of measurement positions different form each other. No such invention has heretofore been taught or suggested in the prior art.

It is therefore noted that the concept of "beam transport efficiency", as discussed throughout the specification, has also not heretofore been taught or suggested in the prior art. Thus, the use of "beam transport efficiency" to measure or estimate energy contamination has also not been taught or suggested in the prior art. In addition, no teaching or suggestion of the phrase "ratio of energy contamination" is found in the art.

Applicants therefore urge that Adibi et al. clearly cannot be considered to teach or suggest any invention as claimed. As previously argued, Adibi et al. contains absolutely no teaching or suggestion with respect to beam electric currents measured at respective measurement positions to estimate a ratio of energy contamination specified by a neutralized ion beam. According to Adibi et al., only one electrode current drain provides a direct measure of energy contamination on a target substrate at energies above the transport energy of ions through the flight tube. However, no disclosure at all is found in Adibi et al. regarding the necessity of measuring, along a beam path, beam electric currents at a plurality of positions different from each other.

Indeed, in this connection, it is noted that Adibi et al. also fails to teach or suggest, in fact does not even mention, any "ratio of energy contamination" or "beam transport efficiency". However, this apparent lack of knowledge by Adibi et al. is consistent with the above discussion, wherein it is pointed out that these two concepts, and thus the use of

"beam transport efficiency" to measure or estimate "energy contamination", have not heretofore been known to those of ordinary skill in the art. Applicants therefore further submit that those of ordinary skill in the art would have no motivation to modify Adibi et al. so as to arrive at any invention as claimed. Although it is alleged at page 9 of the Office Action that it would have been obvious to derive energy contamination over transport efficiency, this is incorrect. In that "beam transport efficiency" and "ratio of energy contamination" were not known to those of ordinary skill in the art at the time of invention, the disclosure in Adibi et al. of only one electrode current drain providing a direct measure of energy contamination, would not suggest to those of ordinary skill in the art that "beam transport efficiency" could be used to estimate a "ratio of energy contamination", by measuring beam electric currents at a plurality of measurement positions, as in the present invention.

In any event, it is further pointed out hat a beam ion neutralized is no longer influenced by magnetic or electric fields, as pointed out in Adibi et al. (col. 7, lines 50-51), and therefore, the neutralized beam ion cannot be electrically monitored or controlled.

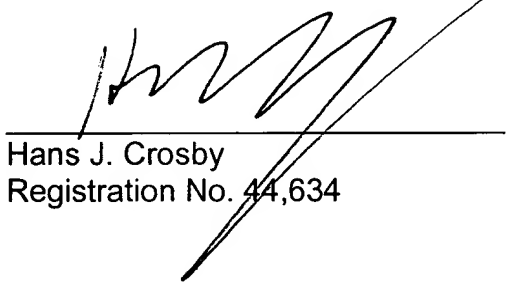
Applicants urge withdrawal of all rejections.

In view of the amendments and remarks above, Applicants respectfully submit that this application is in condition for allowance and request favorable action thereon.

In the event this paper is not considered to be timely filed, Applicants hereby petition for an appropriate extension of time. The fee for this extension may be charged

to our Deposit Account No. 01-2300, along with any other fees which may be required with respect to this application, referencing Attorney Docket No. 107443-00007.

Respectfully submitted,



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Enclosures: Marked-Up Copy of Amended Specification and Claims
Petition for Extension of Time

MARKED-UP COPY OF AMENDED CLAIMS

4. (Thrice Amended) The ion implantation apparatus as claimed in claim 3, further comprising means for measuring [wherein] the correlation [is specified by] from an inverse proportion relation between the energy contamination and the beam transport efficiency.

6. (Thrice Amended) The ion implantation apparatus claimed in claim 5, further comprising means for measuring [wherein] the ratio of the energy contamination [is determined in consideration of] from a deceleration ratio which is defined by the ratio of implanted ion energy to the extracted ion energy.

9. (Thrice Amended) A method of implanting ions into a wafer, comprising the steps of:

setting a beam transport efficiency to a predetermined value; [to decrease]

decreasing a neutral fraction of the beam; [and]

monitoring the beam transport efficiency; and [to reduce]

reducing an energy contamination to a value lower than a target value.

22. (Thrice Amended) The ion implantation apparatus as claimed in claim 10, wherein a beam transport efficiency is measured before the beam starts to impinge upon a wafer.

23. (Thrice Amended) The ion implantation apparatus as claimed in claim 15, wherein a specified ratio of energy contamination is set in each implantation recipe [ ] a specified ratio of energy contamination is set in each implementation recipe], which is automatically converted to the limit of the beam transport efficiency.